Dog Breed Classifier

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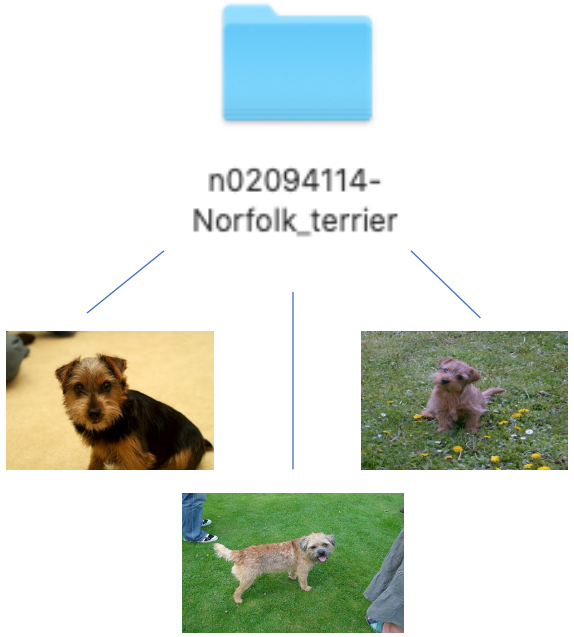
Problem Statement

I chose to look at dog breeds and see if I could create a CNN to classify a large amount of dog breeds. This is fairly similar to the cats and dogs exercise, except now the model is supposed to classify 120 dog breeds instead of 2 species. This is especially challenging as a lot of dog breeds look incredibly similar. Additionally, size isn't really an identifiable dog breed characteristic in the images, so dogs that look similar in every way but size (like bulldogs and French bulldogs) are more difficult to classify.

Data

The data comes from the Stanford Dog Breeds Dataset, which is within Stanford Vision Lab's ImageNet Image Database, with over 14 million images. I used 12,000 training images and 8,580 testing images. The image size varied, so I set a target size to 300 by 300. The data covers 120 dog breeds. The number of pictures per breed varied.



Method

```
model = tf.keras.models.Sequential([
   tf.keras.layers.Conv2D(16, (3,3), activation='relu',
                          input_shape=(300, 300, 3)),
   layers.MaxPooling2D(),
   layers.Conv2D(32, 3, activation='relu'),
   layers.MaxPooling2D(),
   layers.Conv2D(64, 3, activation='relu'),
   layers.MaxPooling2D(),
   layers.Flatten(),
   layers.Dense(64, activation='relu'),
   layers.Dense(120)
])

model.compile(optimizer='adam',
          loss=SparseCategoricalCrossentropy,
          metrics=['accuracy'])

history = model.fit(
    train_generator,
    validation_data = validation_generator,
    epochs=15,
    steps_per_epoch=60,
    validation_steps=44,
    verbose=1)
```

Unfortunately, due to time and computing restraints, I wasn't able to implement my code in practice. If I did implement my code in practice, I would have tested different numbers of neurons for each Conv2D and Dense layer. Additionally, I would have tried RMSprop with different learning rates in comparison to Adam.

Model Performance

With more time and project support, the model would ideally be +90% accuracy for validation and training data. Additionally, the model would be able to classify all 353 official dog breeds ("official" meaning recognized by the WCO) rather than just 120.

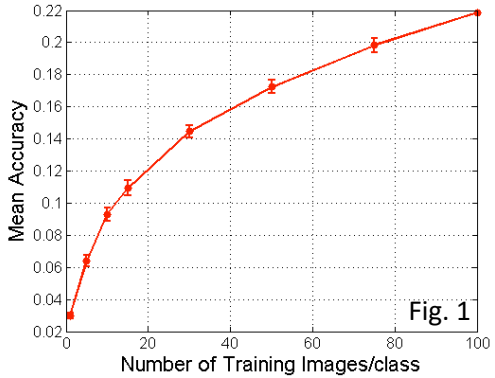


Fig. 1

```
Test accuracy (VGG19): 46.0526%
Test accuracy (Resnet50): 82.4163%
Test accuracy (Inception): 80.5024%
Test accuracy (Xception): 84.6890%
```

Fig. 2

Fig. 1 shows the results achieved by a group of Stanford students when creating a model themselves. At around 100 training images per class, the mean accuracy (the average accuracy of all classes), was only 22%. Compare this to Fig. 2, the results of the premade models tested by Ravi Gopalan, one could conclude that strong results are possible, but difficult to achieve from scratch.